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**Evaluation of a model bear viewing program
at Glendale River with policy recommendations**

Funded By:
Grizzly Bear Trust Fund
Knight Inlet Resort

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1. Introduction

The Pacific mid-coast region of British Columbia has a mild, hypermaritime climate that places its biological productivity in the range of tropical rainforests. The low elevation river valleys are characterized by rich alluvial soils, further enriched annually by upstream nutrients flooding over the stream banks of the floodplains and distributing rich silt to the roots of giant Sitka spruce and Western hemlock forests.

Unique to Canada's rivers flowing into the Pacific (but not north into the Mackenzie River, for example) are the massive contributions of nutrients from the bodies of 5 species of anadromous salmonids. This flux of organic matter has long been recognized as essential to the production of young salmon but the additional fertility increment to riparian and upland forests is currently under intense investigation (Bilby et al. 1996; Cederholm et al. 1989; Willson et al. 1998). The role of migratory salmon in supporting dense populations of grizzly bears has recently been demonstrated for a large sample of coastal bears in Alaska (Miller et al 1997). A strong statistical correlation between the per cent of meat, mainly salmon, in the diet and bear density (Hilderbrand *et al* 1999) confirmed earlier speculation by Miller et al. (1997) that Alaskan's most dense bear populations also had high salmon diets and were among the most dense on a world-wide basis.

Grizzly or brown bears on the coast of British Columbia and Alaska are the same species as the grizzly bears of the Rocky Mountains. However they are much bigger and have higher population densities because of abundant of salmon (Hilderbrand *et al.* 1999). Alaska population densities vary from a maximum of 550 bears /1000 sq. km in Katmai National Park where salmon are seasonally available to less than 5 for mountain bears of the eastern Brooks Range on a marginal food base (Miller et al. 1997).

Coastal Alaskan bears forage widely for fish. At Brooks River in Katmai National Park & Preserve bears feed on sockeye salmon starting in late June as soon as they enter rivers to spawn. Hundreds of bears have daily access to salmon when the salmon are rich in fat, a fuel used to ascend rivers, build redds, mate and defend their nests against others. Bears feed on these fish which have 50% of their caloric value in fat. From Katmai's Brooks falls bears migrate with the fish to their spawning beds and, later, back to the stream mouths where the dying fish are again consumed in prodigious numbers. The end result of this movement is a pattern of deposition of fish pieces and feces over the landscape. Studies in the state of Washington of the fate of salmon carcasses showed that 22 species of mammals and birds carried salmon pieces into the forest (Cederholm and Houston 1992). The nitrogen in the fish parts and bear feces is incorporated into plants and animals in the forest and in the streams therefor enriching the ecosystems there. Bears are one of the largest contributors because of the massive amount of material that they consume and the great distances that they move.

Many of the Alaskan sites with the highest bear densities have become popular, and profitable, tourist destinations. More recently a bear viewing/eco-tourist industry has begun to develop in British Columbia.

In March 1998 bear viewing policy and guidelines were presented in which the government expressed support for the use of bears for tourism. This study addresses the impacts of viewing on bears and presents recommendations for further research and the sustainable development of bear viewing in the province.

2. Methods

This study was performed in the Glendale Cove area of Knight Inlet, British Columbia, Canada (Figure 2.1).

The research design followed established field techniques (Chi 1999, Chi and Gilbert 1995, Olson *et al.* 1990). Data was collected in a rigorous sampling design on:

bear numbers -	scan sampling
bear identification -	photo-identification
age/sex class -	photo-identification
time budgets -	scan sampling and continuous focal animal sampling
fish capture -	continuous observation and continuous focal animal sampling
arrival/departure directions -	continuous observational mapping
social/aggressive interactions -	continuous observation
human caused disturbance -	continuous observation

As with Olson (1993), no significant difference was found between time budgets estimated by scan sampling and those recorded by continuous focal animal sampling.

With the exception of spatial data, which had a circular normal distribution (Zar 1996), all data were non-normally distributed. Since extreme transformations to normality were inappropriate in this data set, non-parametric statistical tests were used.

3. Summary of Results

Through spring and summer the bears in Glendale Cove spend much time foraging on the estuary and in dense berry growth in the red alder stands in the Glendale Valley. Many bears also search for marine invertebrates (mollusks, isopods, crabs, etc.) in the inter-tidal zone. When salmon first became available in late August, bears concentrated their fishing activities in shallow pools in the mouth of the Glendale River at low tide.

Bears were observed searching for fish at the weir as early as August 23. Low numbers of bears were seen consistently at the weir from this date onwards. No bears were observed catching fish, however. Prior to the start of active fishing at the weir, increasing numbers of bears were sighted each day on the estuary and in the inter-tidal zone. Once salmon numbers were sufficient, bears were observed, at the weir, fishing at all times of the day and night. Fishing continued through October 8, the end of the study period.

The following were observed; details are provided in section 5:

- The population is highly skewed towards females with cubs.
- During bear viewing tours representation of different age/sex classes did not differ significantly from their representation in the population.
- When bear viewing tours were absent sightings of large males and lone females increased and sightings of females with cubs and other males declined.
- The proportion of time that bears spend fishing declined when bear viewing tours were present. (This does not affect all age/sex classes equally [see section 5.2.1.])
- Fish capture rates were not affected by the presence of bear viewing tours.
- Arrival and departure directions used by the bears were unaffected by current viewing structures, either while in use or while empty.
- The presence of bear viewing tours seems to suppress social interactions between adults.

4. Human Activity Patterns

4.1. Daily and Seasonal Patterns

4.1.1. Bear Viewing

Bear viewing tours operate in Glendale Cove from early May through mid October. Early season tours are mainly restricted to boat based viewing from the cove. During the salmon run bears are observed from 4 permanent viewing structures operated by Knight Inlet Lodge (hereafter KIL), vehicle based viewing operated by Tide Rip Tours and from walking tours operated by Discovery Tours.

During the 1999 season, viewing of bears at the weir began on September 1, within days of the first observed catch, and continued beyond the end of the study (October 8).

The daily viewing periods for different groups using the site are illustrated in Figure 4.1.1. This illustration shows the periods during which different user groups typically view the bears and is not representative of viewing on any one day, although these viewing periods were all used and even exceeded on some days in the 1999 season. KIL has been separated from other operators in this illustration because of the consistent daily schedule of their viewing activities as compared to the periodic schedule of use by other operators. The category "Commercial" refers to professional photographers and film crews who, while guests of KIL, operate in small numbers (1-3 people) on a different schedule from other bear viewing tours.

It can be clearly seen from Figure 4.1.1 that while individual operators may strive to leave 40-50% of daylight hours free of viewing this is not happening. Since each operator faces different constraints on their viewing periods it is difficult to see how multiple operators can function together without strict regulation of viewing periods. If the presence of bear viewing tours is having a significant impact on the bears the question of how much viewing can be allowed must be addressed.

4.1.2. Fisheries Management

The Department of Fisheries and Oceans operates the spawning channel on the Glendale River. The management and maintenance of the system requires that DFO employees visit the site several times each year. While these activities are clearly important to the maintenance of the salmon run and the physical structures associated with the spawning channel, visits during the spawning season can have a great impact on the bears.

The impacts of these visits are clearly illustrated by the following example. On September 8 1999 the DFO came to the spawning channel to collect fish samples. During the 6 hours that they were on the site their helicopter made no less than 5 very low passes or landings at the weir, 2 bear bangers were discharged and numerous rocks were thrown at passing bears. In the days leading up to the visit consistently high, and even increasing, numbers of bears had been observed fishing at the weir. In the days immediately following the visit 50% fewer bears were seen.

With more planning and bear awareness training these impacts could be reduced.

4.1.3. Hunting

There is currently a 17.5 km² hunting closure around the Glendale River spawning channel. This includes the valley bottom from the estuary upstream to the spawning channel and continues upstream towards Glendale lake.

The fall brown bear hunting season in this part of British Columbia runs from October 1 to November 15; the spring season runs from April 1 to May 31. Both of these seasons overlap with the bear viewing season. By October, bears in the Glendale Valley have been encountering non-threatening humans regularly for 5 months and, if they have been fishing at the weir, they have been coming into close daily contact with non-threatening humans for at least a month. This makes these bears extremely vulnerable to hunters when they move outside the small closure around the spawning channel.

As has already been mentioned in Section 3 that age/sex class distribution of this population is skewed towards females with cubs. This may be indicative of heavy losses of large males to hunting or poaching and is addressed in more detail in Section 5.1.

4.2. Other Bear Viewing Sites

Some concerns have been expressed that viewing stands, vehicles and people are all too close to bears as they approach the fish weir to feed. How do KI bear tours compare with long-established bear viewing sites in Alaska in regard to distances between public viewing platforms and feeding bears? The following points are based on one of the author's (BKG) experience during behavioral research over 10 years at Brooks River in Katmai NP, Anan Creek, Tongass NF and Fish Creek, near Hyder Alaska. We also have reviewed the extensive literature on other bear viewing sites at McNeil River State Game Refuge, Stan Price State Wildlife Sanctuary (Chichagof Island) and O'Malley Creek Observatory on Kodiak Island.

4.2.1. Behavioral Response

KI bears respond similarly to Brooks River bears to people, boats, buses and aircraft. As with other highly habituated bears, this Alaskan population of 50-60 bears feeds along a sockeye salmon stream without threatening people at close range or causing injuries. This tolerance is not "taming" or unnatural; bears and other wildlife learn to ignore activities that are not threatening or rewarding of foods. Habituation is a psychological process that, in the case of bear viewing, permits coexistence.

The data presented here suggest that a threshold is being passed when about 15 people are present (See Section 5.2.). Similar signs of intolerance and avoidance of groups by some bears was documented at Brooks and Anan.

4.2.2. Proximity of Viewers to Bears

The positioning of one of the KIL viewing structures within 20m of the weir give guests on this stand an intimate experience of bears feeding on salmon. Some concern has been expressed about the placement of this stand. Our data show no impact of the current viewing structures on the spatial distribution of bears at the site (Section 5.4.).

While there may be some aesthetic impacts on the experience of viewers at other locations and some bears may be wary, there is nothing extraordinary about the proximity of bears and people at KI in our observations and experience (Figures 4.2.2.1 - 4.2.2.2).

It seems inappropriate to us to compare viewing from stands at the highly modified landscape of KI with bear viewing protocols and standards of "etiquette" toward bears at Kutzemateen River estuary. There the bears are foraging on dispersed summer foods in an unmodified, pristine surrounding and may be more vulnerable to harassment.

We also speculate that KI bears have more "watchdogs" looking after them and thus may be less likely to be exposed to illegal hunting or vandal harassment. We expect that this would build trust toward people over time in the KI bears and increase their ability to safely intermingle with people.

4.2.3. Wildlife Professionals

It is our experience that biologists, bear managers and fisheries technicians without direct, up-close experience with brown bears on a regular basis often persist in harboring negative stereotypes of risks from bears. These attitudes may be accentuated by ill-conceived training by people who hate bears or who only believe in the use of overwhelming force to deal with them. Well-trained and knowledgeable biologists in British Columbia have little opportunity to gain personal experience with bear viewing. Furthermore, there has been little tradition of tolerance among provincial wildlife managers, as there is in Alaska, of bear viewing as an important use of the resource. This, fortunately, is changing. Further progress and understanding could occur if biologists were encouraged and supported in their efforts to gain first hand experience of bears by visiting KI for 3-5 days. Important experience and first-hand understanding of the adaptable nature of these magnificent animals is crucial.

5. Bear Activity Patterns

Analysis of behavioral and activity patterns is based on more than 8200 minutes of observations at the Glendale River artificial spawning channel. All observations were made from the Knight Inlet Lodge viewing structure nearest to the weir. Cubs were excluded from this analysis since they replicate their mother's activity patterns. A small number of bears could not be assigned to an age/sex class because their sex was not determined. These bears were categorized as "Unknown", this class was very small however and so the observations for these bears were grouped with those for the age/sex class "Other Males", the class to which they were most similar, for analysis.

5.1. Age/Sex Class Distribution of Population

In 1999 38 bears were identified in the Glendale Cove area on Knight Inlet, BC (Table 5.1.1, Figure 5.1.1).

Table 5.1.1: Identified Bears

	Number
Large Males	4
Other Males	4
Unknown	3
Lone Females	4
Females with Cubs	8
Cubs	15

36% of the adult bears identified in this study were females with cubs. When compared to other studies (Darling 1987, Dean 1976, Martinka 1974, Murie 1981, Olson *et al.* 1990, Olson and Squibb 1990), the proportion of the population made up of females with cubs exceeds all similar sites. This could indicate that:

- the population is still growing
- large males are avoiding all contact with humans and so are underrepresented in our population estimate
- hunting pressure has suppressed the number of large males in the population
- some combination of the above factors is acting on the population

Without further study of the KI population it will not be possible to identify the cause of this skewed age/sex structure.

Table 5.1.2: Age/Sex Class Distributions

	Population	Tours Absent		Tours Present	
	%	% of observed bear minutes	+/-	% of observed bear minutes	+/-**
Large Males	17	33	+	20	0
Other Males	17	23*	-*	23*	0*
Unknown	13	*	*	*	*
Lone Females	17	26	+	23	0
Females with Cubs	36	18	-	34	0

**Individuals of unknown age sex class were included in "Other Male" for analysis*

*** No significant change at $\alpha = 0.05$*

The number of bears present is not significantly different between viewing and non-viewing periods.

It can be seen (Table 5.1.2, Figures 5.1.2 - 5.1.3) that when bear viewing tours were present each age/sex class was observed with a frequency which did not differ significantly ($\alpha=0.05$) from its representation in the population. Large increases in the activity of bears in the large male age/sex class were observed during periods when tours were absent.

Large males dominate good feeding sites therefore females with cubs, and sub adults, avoid these sites. By suppressing the activity of the dominant age/sex classes, the presence of tours allows subordinate age/sex classes to take advantage of these sites, a refuge effect.

5.2. Time Spent Fishing

5.2.1. Analysis by Age/Sex Class

Table 5.2.1: Time Spent Fishing

	Tours Absent	Tours Present	
	% of Observed Bear Minutes	% of Observed Bear Minutes	+/-
Large Males	68	53	-
Other Males	83	55	-*
Lone Females	88	73	-*
Females with Cubs	58	72	+

** Significant at $\alpha = 0.05$*

5.2.2. Analysis for all Bears

Table 5.2.2: Time Spent Fishing

	Tours Absent	Tours Present	
	% of Observed Bear Minutes	% of Observed Bear Minutes	+/-
All Bears	81	68	- *

* Significant at $\alpha = 0.05$

With multiple operators, tours were, at times, present for periods extending to almost 100% of daylight hours (Figure 4.1.1). Given the reduced feeding observed while tours were present, this equates to a loss of more than 16% of daylight feeding at this site (See also Figure 5.6.1). As has been seen (Section 5.2.1.) that this loss of feeding time is not distributed evenly across the population (Figures 5.2.1 - 5.2.2).

Figure 5.2.4 shows that disturbance increases as viewing densities increase. It is unclear whether the step function (a), or the inverse-square relationship ($y = 1-8x^2 \cdot 10^{-4}$) (b), best describes the relationship. It is clear however that at higher viewing densities the level of disturbance begins to increase rapidly.

5.3. Fish Capture Rates

Table 5.3.1: Fish Capture Rates

	Tours Absent	Tours Present	
	Rate	rate	+/-
Fish caught per bear minute	0.21	0.16	-
Fish caught per bear fishing minute	0.26	0.24	0

Viewing does not appear to effect the efficiency with which bears capture fish while fishing. The reduction in the number of fish caught per bear minute is rather a reflection of the behavioral changes outlined above.

5.4. Spatial Distribution of Bears Approaching and Leaving the Weir

Analysis of spatial data using Rayleigh's test for Circular uniformity (Rayleigh 1919, Zar 1996) shows that there is no avoidance of the current viewing structures; approach and departure frequencies are evenly distributed in all sectors (Figures 5.4.1 - 5.4.4) both while bear viewing tours are present and while they are absent.

5.5. Effects of Bear Viewing Tours on Adult Social Behavior

While tours were present social and aggressive behaviors among adults were never observed. However these behaviors were observed among large males and lone females during periods when tours were absent. These observations support the hypothesis that these age/sex classes, especially large males, are less tolerant of human presence.

5.6. Bio-Energetic Effects of Disturbance on Bears

Figure 5.6.1 illustrates the potential impact on available fishing time at different levels of viewing. In this illustration the effects outlined above are combined with the number of viewers kept constant.

Population density of brown bears is directly related to the level of meat consumption (Hilderbrand *et al.* 1999). The correlation Hilderbrand describes suggests a highly significant direct relationship between access to and ingestion of a high quality source of nutrition (in this case animal tissues) and population density. It is not only the availability of high quality food resources that effects population density but also the timing of its seasonal availability. The availability of highly digestible meat resources, such as spawning salmon, in late summer and fall improves population productivity by providing the resources required for reproduction (Gilbert and Lanner 1995). Strong positive relationships between dietary meat and mean litter size and mean female mass were also found by Hilderbrand *et al.* (1999).

As viewing periods are increased the opportunities for fishing at the weir decrease. It is not known if, or how well, bears can substitute fishing at other locations on the Glendale River for opportunities lost at the weir. It is known, however, that reducing the availability of salmon by removing fishing opportunities will have negative impacts on the population density, size and reproductive output of KI bears.

6. Safety

Safety assessment at KI, compared to Alaskan bear viewing sites, can be discussed in the context of site characteristics (e.g. separation of the lodge from the viewing area) as well as operational behavior and facilities.

6.1. Visitor Accommodation

KIL is the only provider of multi-day tours to the site. Accommodation, food and other facilities are located across the cove from the bears and are situated on floats. This separation provides a significant advantage for safety and the protection of bears since no food, sewage or other attractants are accessible to bears.

6.2. Attractants

No garbage, food storage or sewage leach fields are situated near the spawning channel. There is therefore negligible risk of bears becoming food-conditioned, leading to property destruction or injuries. No food or drinks are permitted at the viewing site by KIL, nor was any eating by KIL guests observed. On one occasion however, a walking tour operated by Discovery tours was observed eating at the weir. At Anan Creek independent visitors from near by towns occasionally brought coolers, including beer, to the observation platform. This was contrary to regulations but no approaches or breaking into containers was observed, perhaps because bears are totally focused on superabundant live fish. The current level of monitoring of strict rules about food should eliminate any risk at the KI site.

6.3. Supervision of Visitors

The nature of the KIL operation, and the constraints of a single day trip offered by other operators, ensure total withdrawal from the viewing site at day's end. At the Brooks River (Katmai NP) viewing site, when rangers go off duty and off the river at 5pm, the public is free to interact with bears in and along the river, unmonitored. Thus KI is safer and poses fewer risks to bears at the weir. When the last tour leaves, KI bears are not disturbed by people, a distinct benefit for bear conservation and public safety.

Visitor safety is maximized, at KI, by the continual presence of experienced guides whose sole role is to direct visitor behavior and interpret bear behavior and ecology. No guests are permitted to tour the area unattended as is common at Brooks River and Anan Creek, sites on USA public lands. Our assessment would rate KIL safety highly; more cautious than Brooks and Anan, perhaps similar to M^cNeil River because of the size of groups. M^cNeil viewers are not guided to an elevated stand but stand or sit for 4-5 hours midday, at ground level, on a gravel pad near fishing bears. At M^cNeil River brown bears pass within 2m of people on occasion.

6.4. Habituation and the Potential for Problem Bears

The degree of habituation of Glendale bears to people is not of concern in regards to predisposition to food-conditioning. This is so far for two reasons:

- bears are separated from food sources across the marine inlet.
- unlike food-stressed mountain grizzlies, coastal brown bears with ample salmon and other foods seem uninterested in aggressively searching for foods near people.

In summary, we would emphasize that the assumed generality about the danger of habituation and food-conditioned learning in bears seems not to apply to coastal bears in BC and Alaska.

7. Management and Policy Options

According to a major study by Miller and McCollum (1999), demand for wildlife viewing in Alaska "is significant and expected to increase". An estimated 23.6 million Americans took trips with wildlife viewing as the primary emphasis (*1996 National Survey of Fishing, Hunting and Wildlife-Associated Recreation*). In the Pacific region, which includes British Columbia and Alaska, wildlife viewing, as the primary trip goal, will experience the highest rate of increase and rates of participation in wildlife viewing will exceed the rate of population growth (Cordell *et al.* 1999).

In a recent publication that asked if eco-tourism is sustainable, Wall (1997) proposed three criteria:

"If tourism is to contribute to sustainable development, then it must be economically viable, ecologically sensitive and culturally appropriate"

Based on their extensive study, *Alaska Voters: Their Wildlife Viewing Trips and Economics* (Alaska Dept. of Fish and Game 1994), McCollum and Miller concluded that wildlife viewing meets all three criteria.

In their 1999 paper, Miller and McCollum found that:

"the *greater* wildlife viewing was a motivating factor for the trip, the *greater* were the in-state expenditures; the *greater* was the likelihood that the trip lasted longer than one week"

They concluded that Alaska could increase economic benefits by marketing wildlife viewing to fewer people who spend more money in different places in Alaska.

Interest in grizzly bear viewing is most desirable. McCollum and Miller (1994) found that visitors were willing to pay \$355 on average for a day trip to see grizzly bears. In comparison, Dall sheep averaged \$108.

7.1. Options For British Columbia

While the demand, marketing and economics of bear viewing were not part of this study, and would be a legitimate and crucial next step by qualified resource economists, we offer the following suggestions based on bear behavior, a successful BC bear viewing business and direct experience of Alaskan viewing programs managed by U.S. government agencies.

7.1.1. Option 1

Expand opportunities for bear viewing in BC on salmon streams and estuary concentration sites. These areas or eco-centers are already being targeted for greater protection (no-hunting zones, limited permitted viewing (e.g. Kutzemateen estuary)). It is becoming widely recognized that such protection from hunting is consistent with the principles of professional population management as well as ethical consideration of fair chase.

Because coastal brown bears in BC, as elsewhere, have special requirements of safety and minimizing disturbance, who will be the responsible manager is uncertain at present. Wildlife managers could designate employees, seasonal guides or volunteers to live onsite. Where an established business has the requisite experience and an accepted written plan, revocable permits seem appropriate. It seems quite clear that unlimited access by inexperienced private operators is inappropriate with bears as it is proving to be for ocean observation of whales. While there are many considerate, ethical operators, it appears that the lure of business returns and competition to "excel" with provision of "experiences" has a high probability of unacceptable impacts on the animals.

7.1.2. Option 2

Bear viewing could continue to be subordinated to traditional trophy hunting interests in the context of provincial management. This is not consistent with the public's attitudes in general, nor even necessarily with other hunters' attitudes. For example, in the study cited above (McCollum and Miller 1994), even among hunting residents in Alaska, the majority of them were not in favor of trophy bear hunting. One might predict that this would be true in BC, especially of the highly mechanized, easy access type of BC coastal brown bear hunting recently witnessed and reported (Horesji et al. 1998, McAllister 1997).

Space does not permit an evaluation of the compatibility of hunting and bear viewing. But conflicts in values are clearly evident with suspicion among hunters in Kodiak NWR that small protected areas on streams will expand under pressure from bear viewing clientele and sympathetic environmental organizations. We suggest that research on the

home range size of females congregating on spawning channels will help rationalize the extent of zone closures. Further, population modeling based on a population of individually recognizable bears (e.g. Glendale) could provide predictions of the benefits of increased recruitment to the population resulting from increased access to salmon and other concentrated foods as a consequence of protection (site specific habituation to people) vs. aversion from hunting. The most serious impacts to populations would occur where the hunting season overlaps the peak period of hyperphagic salmon eating.

If BC decides to better exploit the international markets for wildlife viewing (specifically coastal species, focusing on bears), the steps recommended in the following quote from Miller and McCollum (1999) are helpful:

- The goals of the [province's] tourism policies must be articulated. A marketing strategy to maximize instate spending will be very different from one designed to maximize the number of visitors
- A benefit segmentation study of [BC's] visitor market should be conducted to identify specific benefit that we seek. [Miller and McCollum 1999] revealed a significant benefit segment, that of wildlife viewing; it was not intended to analyze other aspects of the visitor industry
- a better segmentation of the specific wildlife viewing experience sought by both visitors and residents is needed. More wildlife viewing opportunities offering a variety of benefits and experiences need to be developed and marketed.
- Wildlife management policies for wildlife viewing need to be articulated. Creating wildlife viewing opportunities requires coordinated efforts among wildlife managers, land managers, and the visitor industry.

8. Recommendations

8.1. Knight Inlet

8.1.1. Viewing Infrastructure

Until further study has been completed on the substitutability of other fishing sites, it is our recommendation that there be no further development of new viewing locations at fishing sites on the Glendale River.

With careful control, the location and use levels of current viewing structures, while having some measurable impact on bear fishing behavior, can be maintained with minimal bio-energetic impact on the KI bear population. Some modification of the current viewing regimen will further minimize these impacts.

Reduction of vehicular traffic close to the weir will be an important step in the process of reducing the impacts of viewing. The simplest reduction in vehicular impact can be achieved by stopping the use of the slope between the KIL stand and the weir for turning buses. A simple ramp, as illustrated in Figure 8.1.1.1, would eliminate the need to walk guests across open ground between the bus and this stand and ease access to this viewing structure.

If vehicles are to be removed entirely from the ground close to the weir alternative methods of accessing the current viewing structures must be considered. Given the fact that bears cross and travel along the roadway regularly and the nature of the steep sided causeway upon which the road is situated (Figure 8.1.1.2), surprise encounters between bears and groups of visitors on foot are likely. At both Brooks and McNeil such encounters are a regular occurrence. However, unlike these sites where safe alternative routes are available for both parties, at the Glendale spawning channel no such alternative exists. Creation of a raised walkway for visitors on the slope of the causeway (Figures 8.1.1.3 - 8.1.1.4) would circumvent this problem by creating an alternative route for human use only. Raising the walkway and placing it to the side of the roadway not only separates guests and bears but also allows bears to pass unobstructed beneath it and leaves the road available for maintenance and other DFO activities.

The removal of the earliest and/or latest viewing periods would provide significantly more undisturbed time for the bears with little impact on tour operators schedules.

8.1.2. Management of Viewing

8.1.2.1. *Setting and controlling viewing periods*

If multiple tour operators are to be allowed to bring bear viewing tours to the Glendale area of KI, viewing periods must be carefully regulated. It is not sufficient that each operator proposes a schedule that provides adequate undisturbed time for the bears, these schedules must be coordinated (Figure 4.1.1). Alternatively, a single operator could propose a simple, easily regulated viewing timetable.

8.1.2.2. *Training of guides*

Staff guiding the visiting public should have a consistent basis in knowledge of bear behavior ecology and human-bear interactions. Guests should expect not only to be safe but to enjoy a superior wild experience without anxiety.

All staff who accompany guests should have attended a 3-4 hour inside training course and have a $\frac{1}{2}$ day of field training.

8.1.2.3. *MELP review/visitation*

Both the regulation of viewing periods and the training of staff will require MELP review and/or site visitation to ensure parity between operators.

8.1.3. Hunting

By substantially extending the current hunting closure in the Glendale area of KI this area can become a resource not only for the eco-tourism industry but also for the conservation, and even the strengthening, of brown bear populations on this area of the BC coast. By protecting an area of high productivity, such as this, we provide a source of dispersing bears which serves to counterbalance losses in surrounding areas of low productivity and high mortality.

8.1.4. Research

8.1.4.1. *Home ranges of bears using this area*

Begin immediately to identify home ranges and access routes (mountain passes) of resident bears. Bears marked with adhering materials (rub tree delivery in mountain passes) may be targeted for micro-chip ID. It is of the utmost importance to the conservation and management of this population that we have an understanding of the home ranges of its members.

8.1.4.2. *Availability of alternative feeding sites*

To effectively manage bear viewing on this site we must not only have an understanding of the impacts at viewing sites, we must also have an awareness of the availability and substitutability of alternative feeding sites.

8.1.4.3. *Age/sex structure of the population - stability*

As outlined in Section 5.1. the KI population does not seem to have a stable age/sex structure. It will take further study to determine the causes of the age/sex structure that has been observed. An understanding of these factors is essential to the management of this population.

8.2. *British Columbia Coast*

8.2.1. Management of Viewing Locations

It is recommended that the management of viewing KI become the model for other similar sites on the BC coast. Access should be controlled by either only permitting one viewing operator or appointing an on site observer.

If locations for viewing are carefully selected using population models based on the salmon density - bear density relationship, a network of reserves can be established along the coast. By closing these reserves to hunting and logging they will become source populations for bears and centers of bio-diversity preservation. Yet, unlike many proposed reserves, these areas will have great economic value because of their use in eco-tourism.

Coordinated efforts to create wildlife viewing opportunities must be initiated among wildlife, land and tourism managers (Miller and McCollum 1999).

8.2.2. Hunting

For the reasons stated in sections 4.1.3., 5.1., 7.1.1., 7.1.2., 8.1.3. and 8.2.1. hunting closures must be established around viewing locations.

8.2.3. Research

Pursue research on modeling of the salmon density-bear density relationship. This is important for the province of BC so that rates of increase can be predicted, providing refined information for extrapolation coast-wide. It should be done at Glendale to benefit from the known, individually recognizable bears at this site.

Analyze economic returns of bear viewing compared to hunting of bears in BC. A case history of total trip expenditures for KIL clients would be especially instructive. A survey of sought after viewing experience by guests at KIL would facilitate understanding of clientele motivation.

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Figure 2.1: Site Map

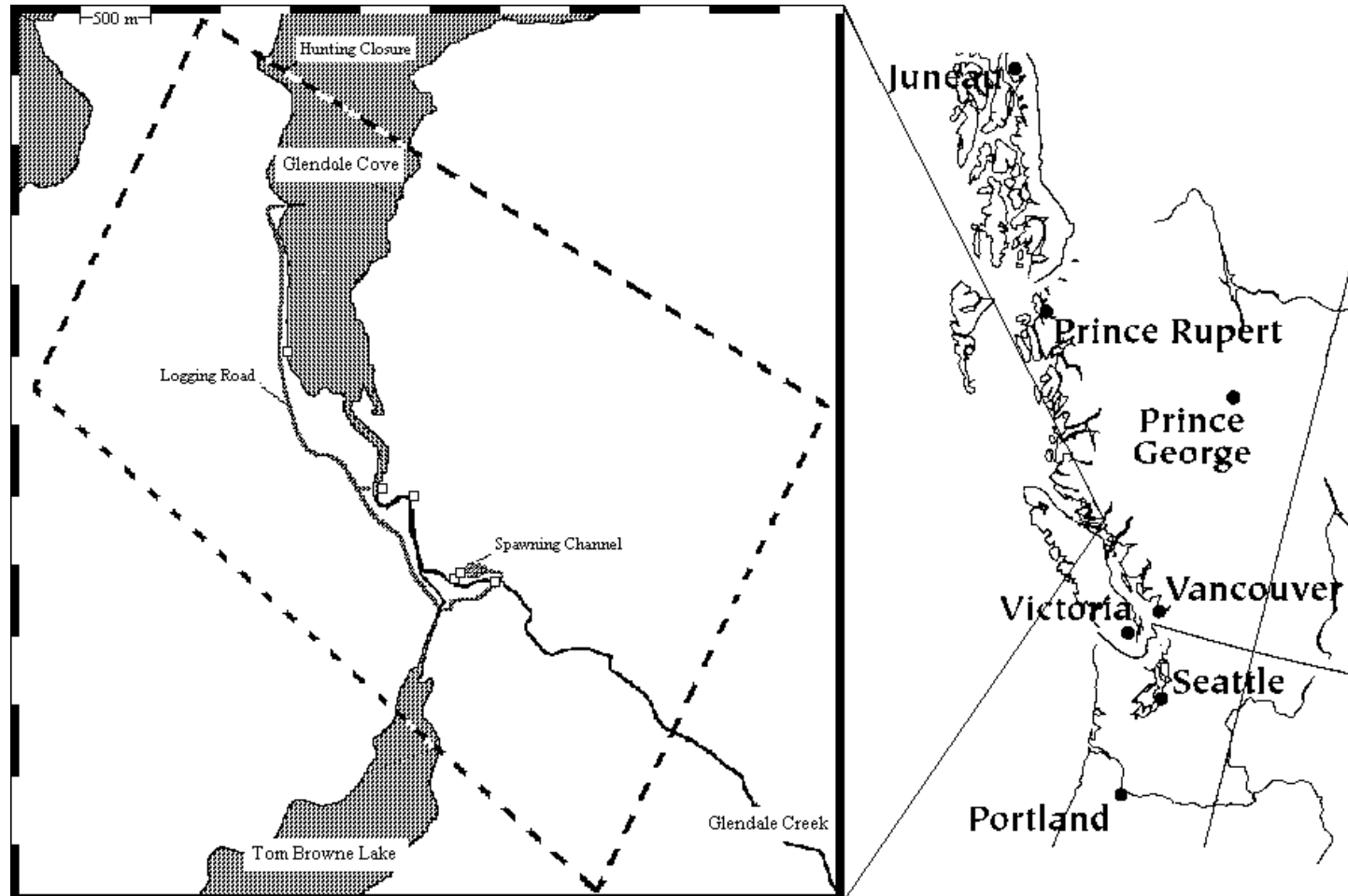


Figure 4.1.1: Comparing Viewing Periods for Different User Groups

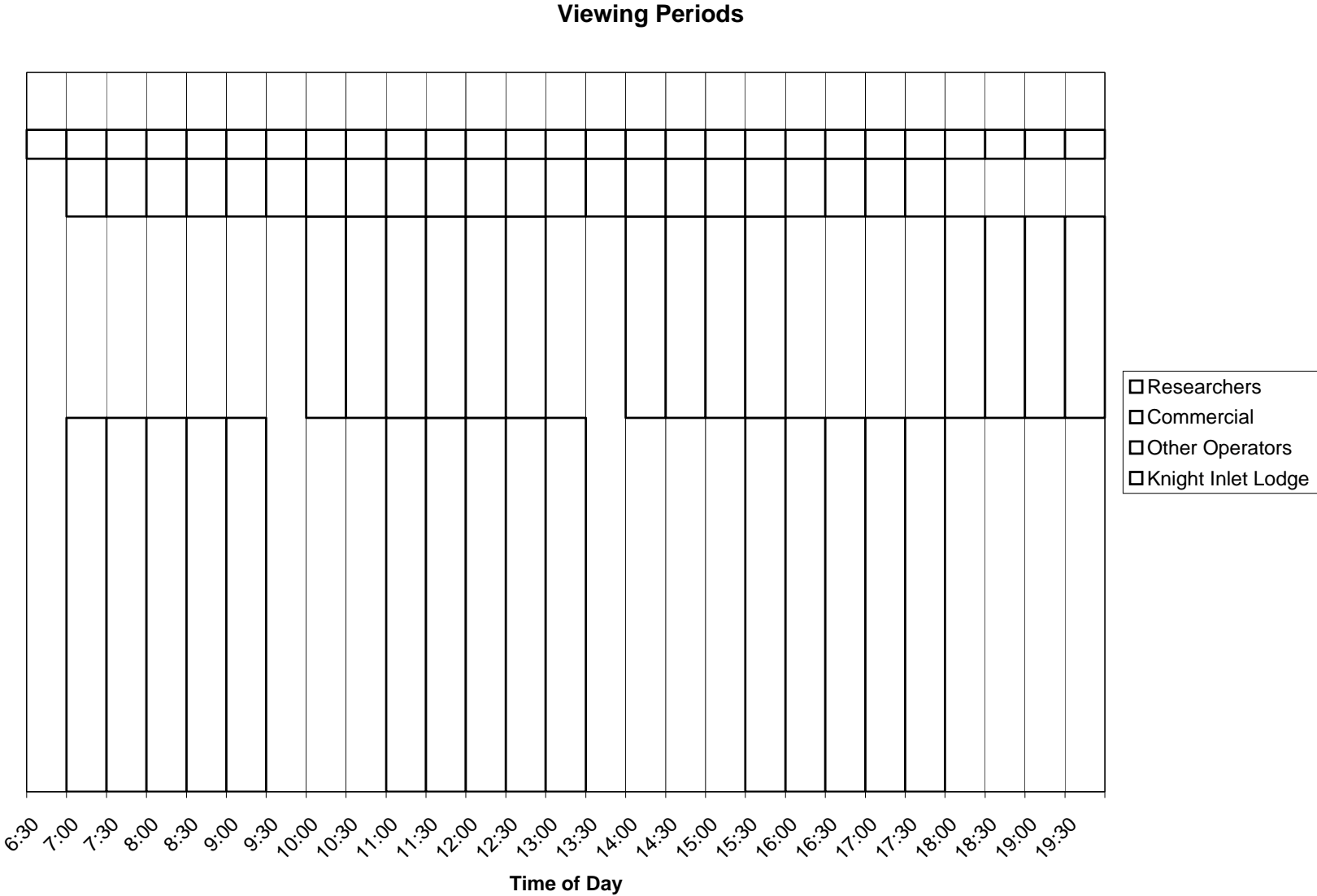


Figure 4.2.2.1: Bear Viewing at Brooks River





Figure 4.2.2.2: Bear Viewing at Anan Creek



Figure 5.1.1: Population of Identified Bears

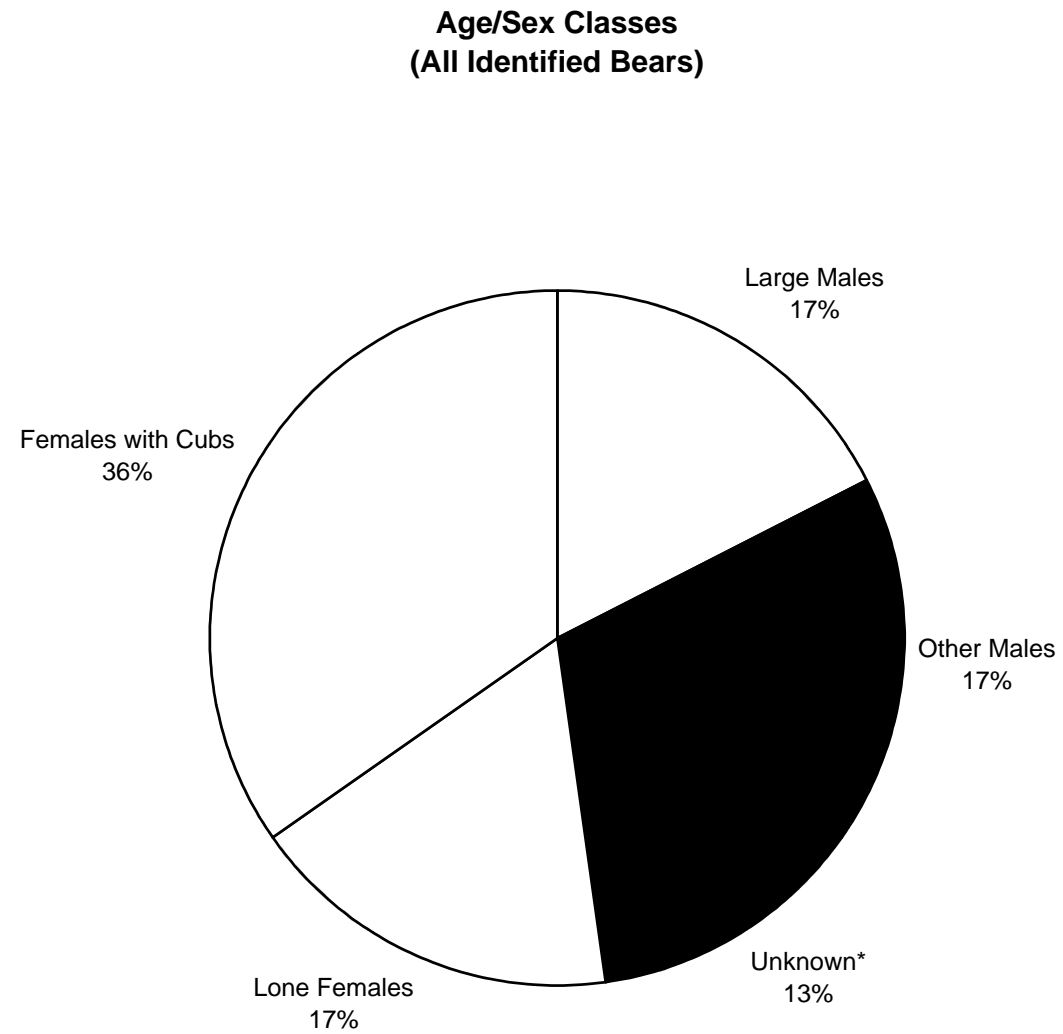


Figure 5.1.2: Proportion of Observed Bear Minutes by Age/Sex Class - Tours Absent

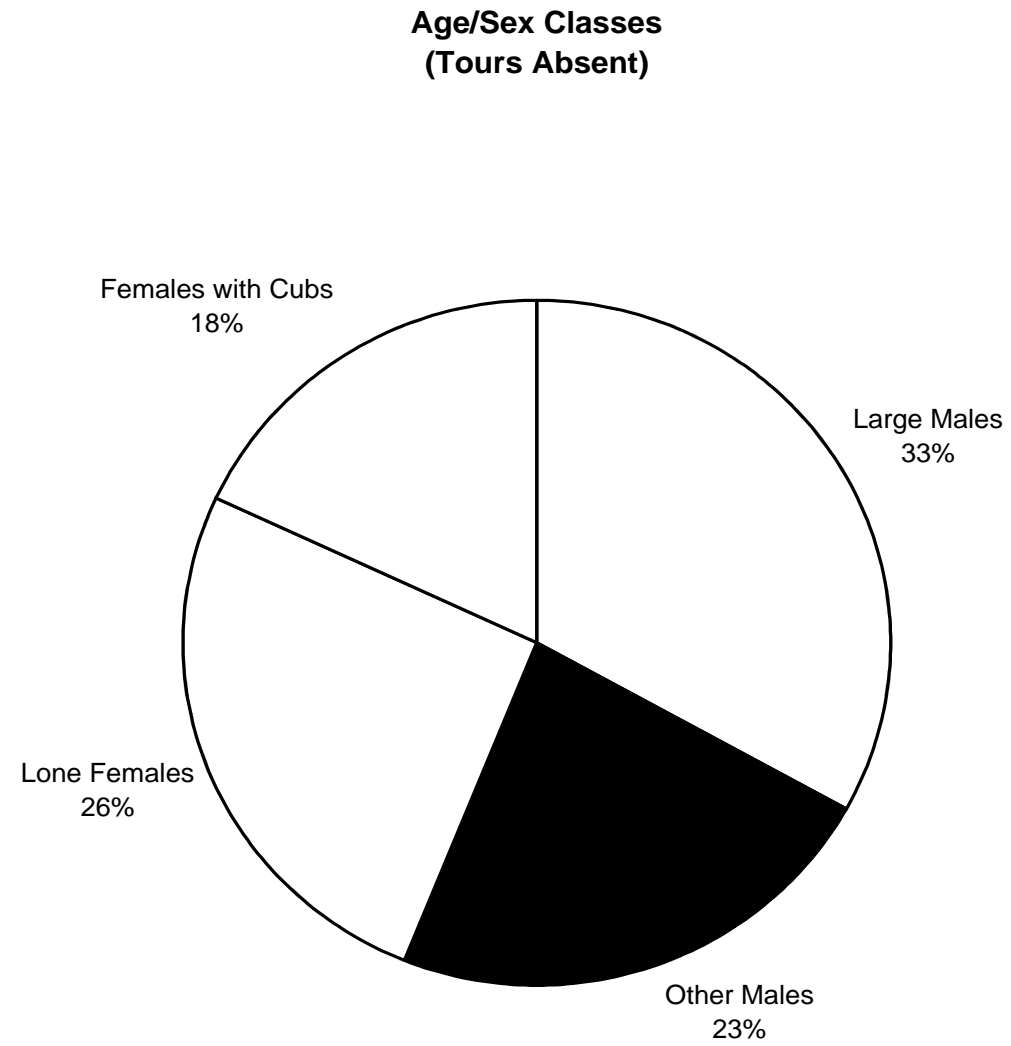


Figure 5.1.3: Proportion of Observed Bear Minutes by Age/Sex Class - Tours Present

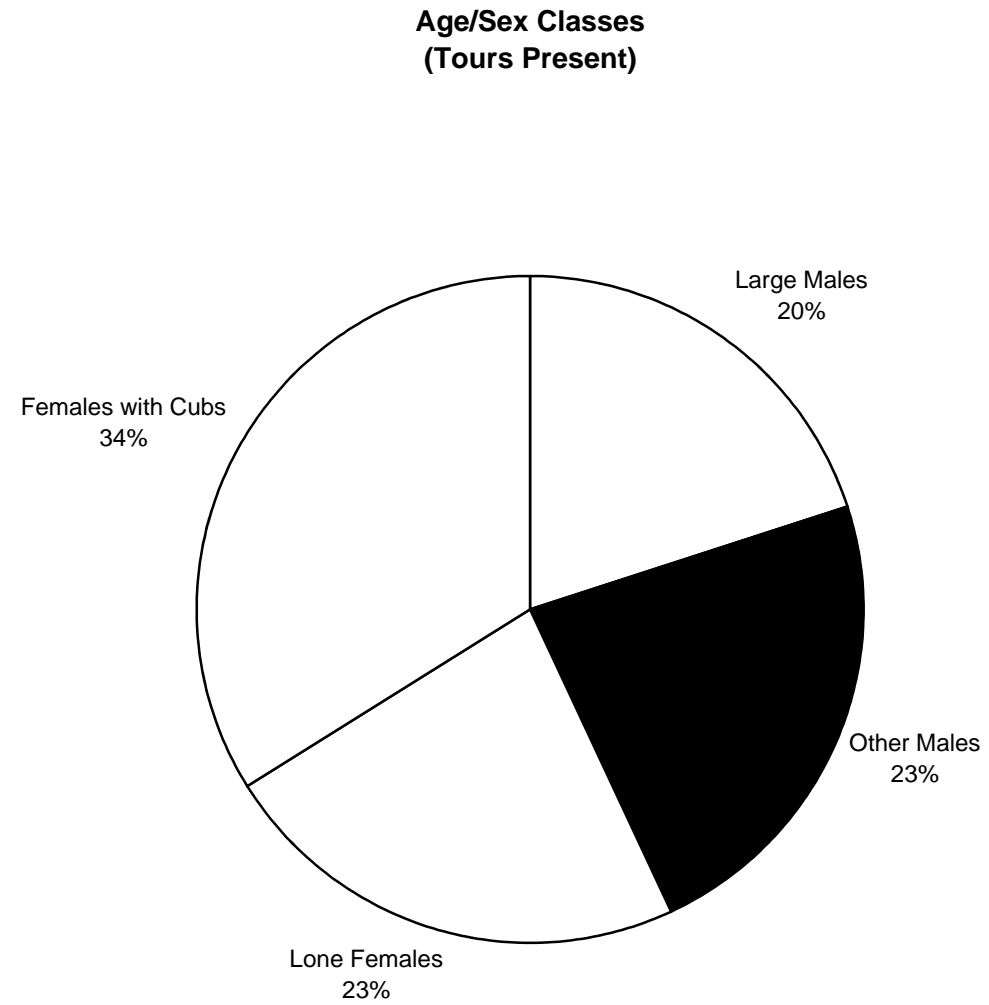


Figure 5.2.1: Mean Time Spent Fishing by Age/Sex Class - Tours Absent

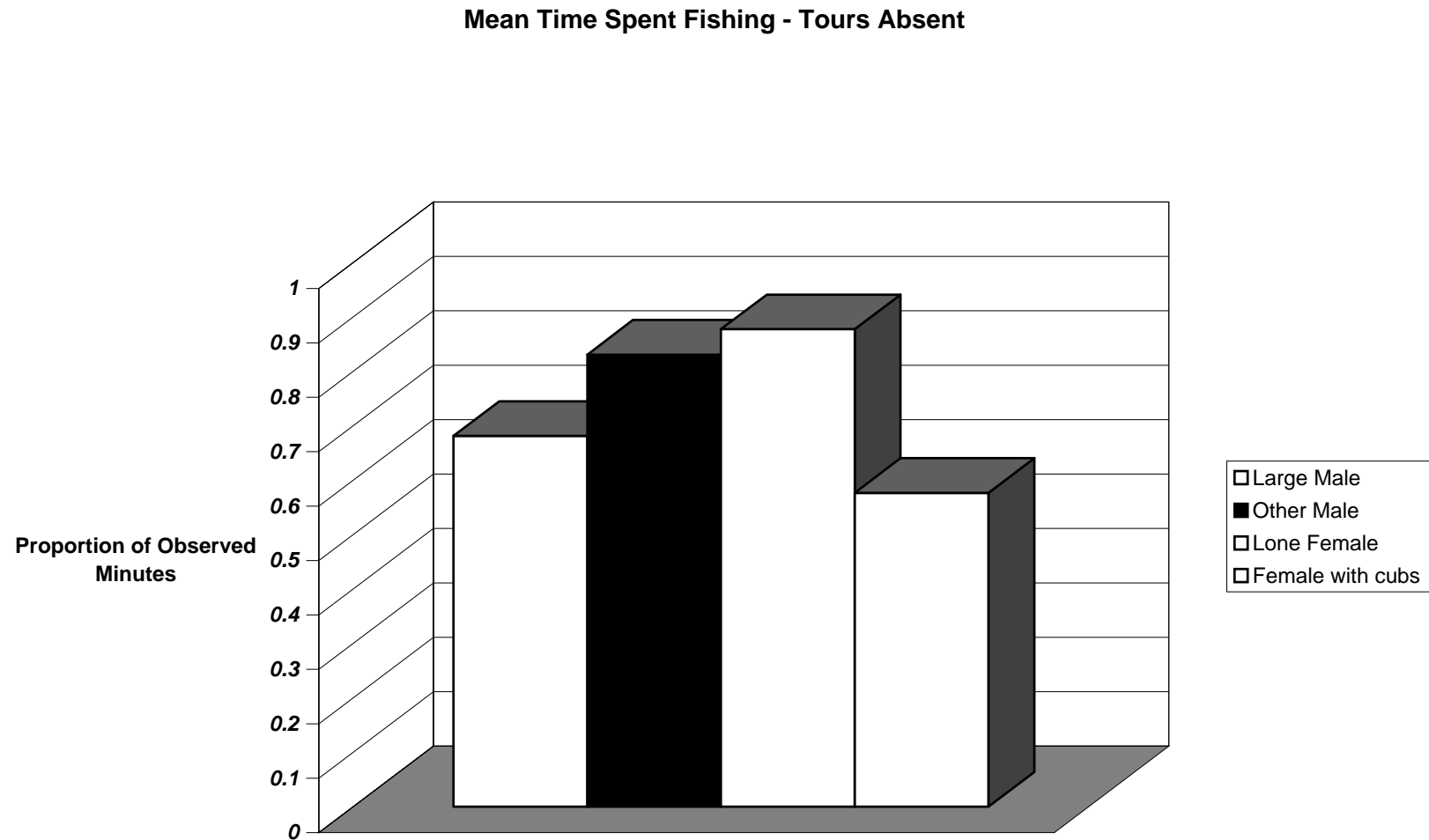


Figure 5.2.2: Mean Time Spent Fishing by Age/Sex Class - Tours Present

Mean Time Spent Fishing - Tours Present

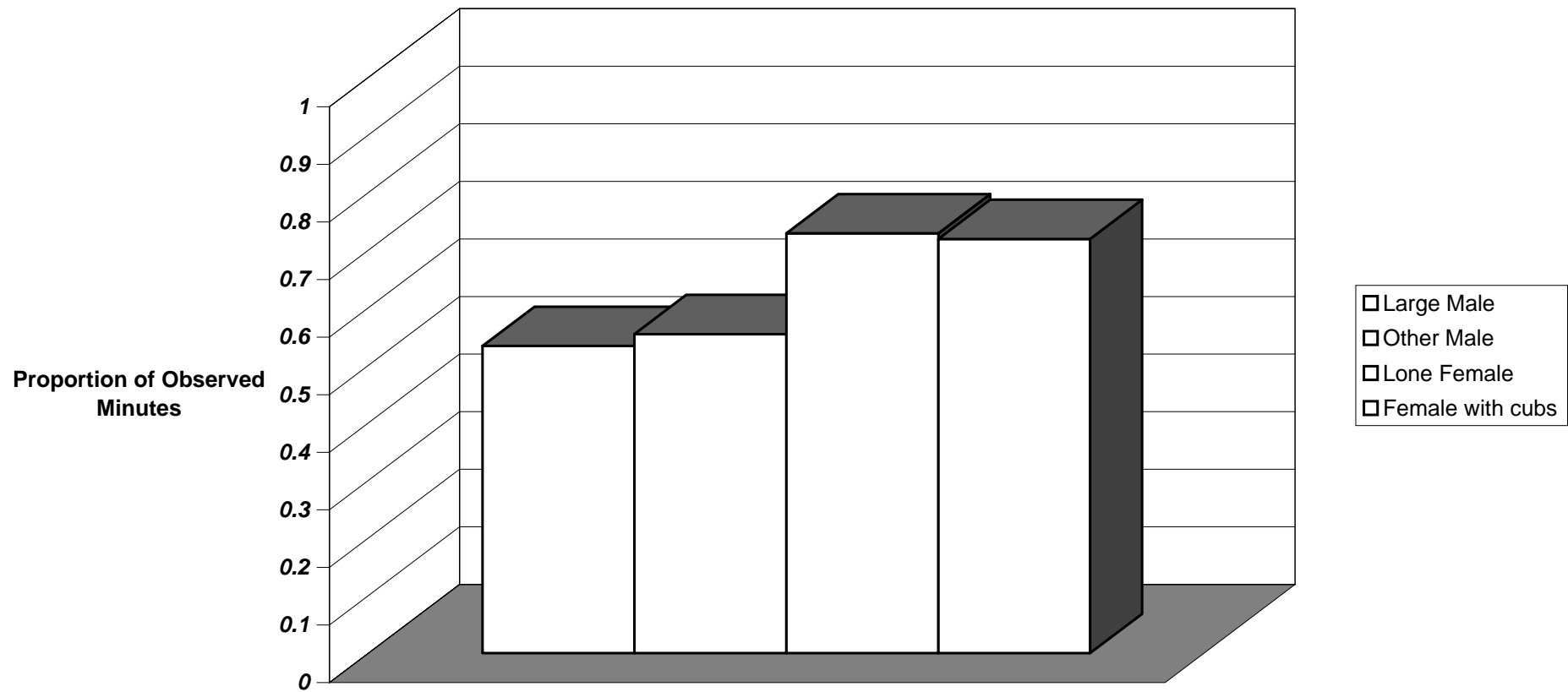


Figure 5.2.4: Maximum Observed Time Spent Fishing - Regression

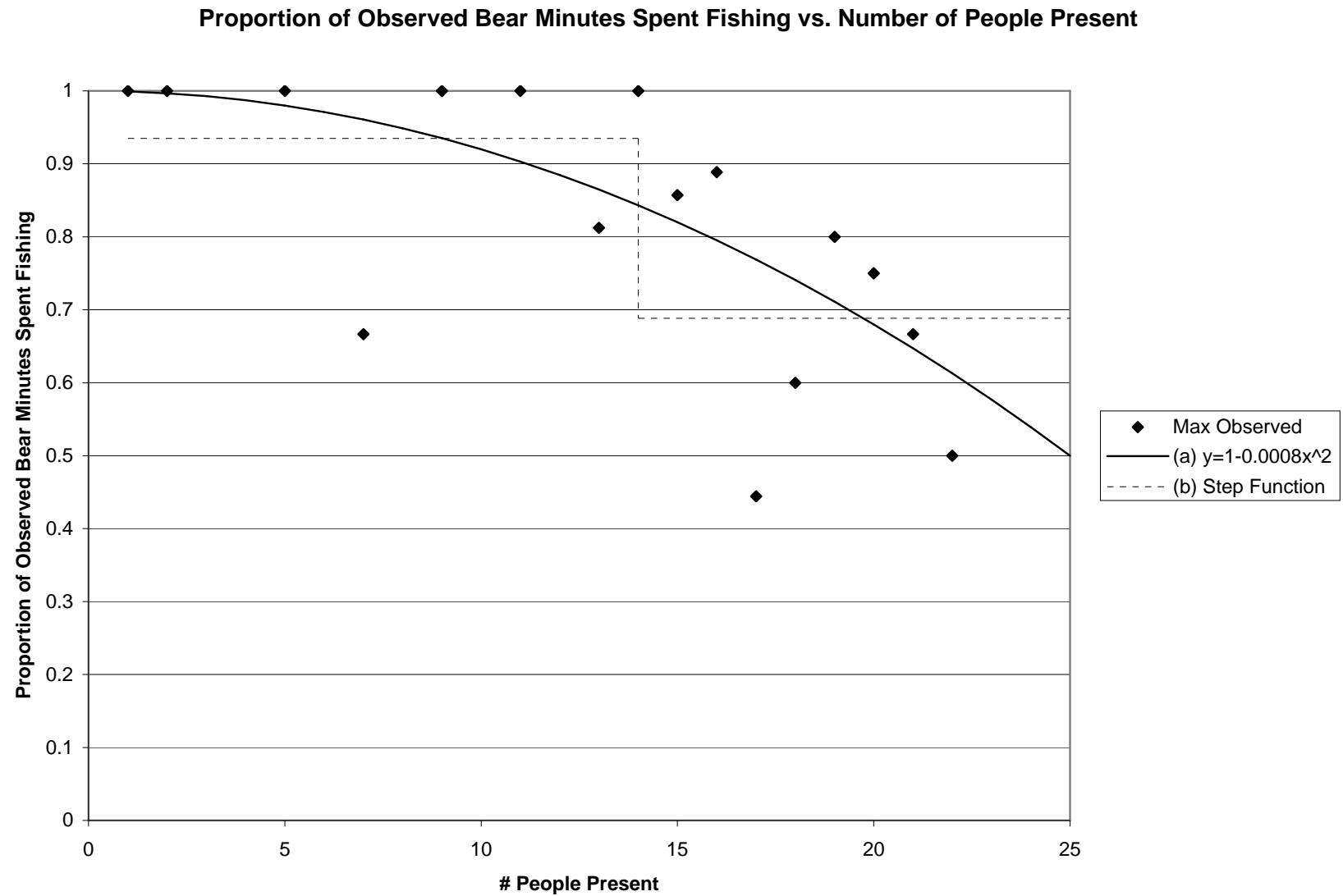


Figure 5.4.1: Arrival Distribution - Tours Absent

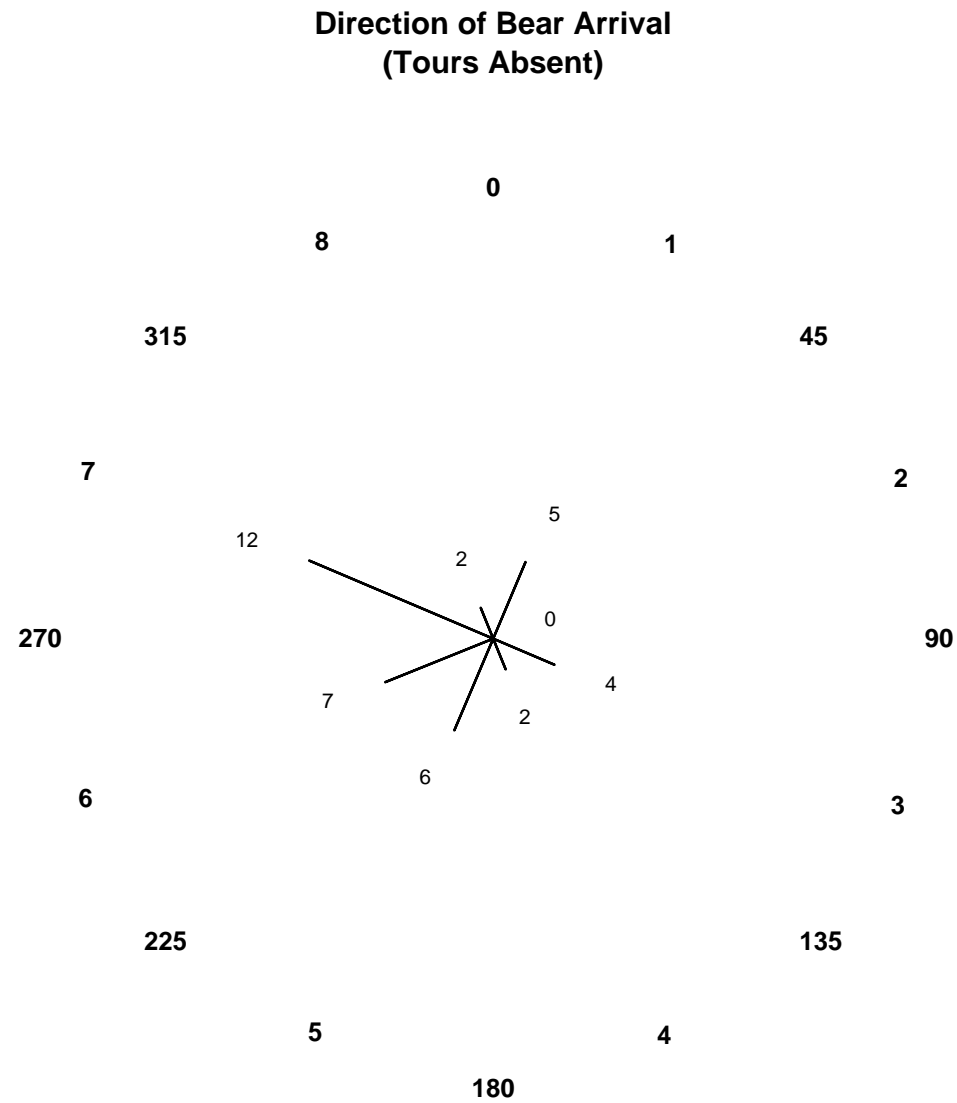


Figure 5.4.2: Departure Distribution - Tours Absent

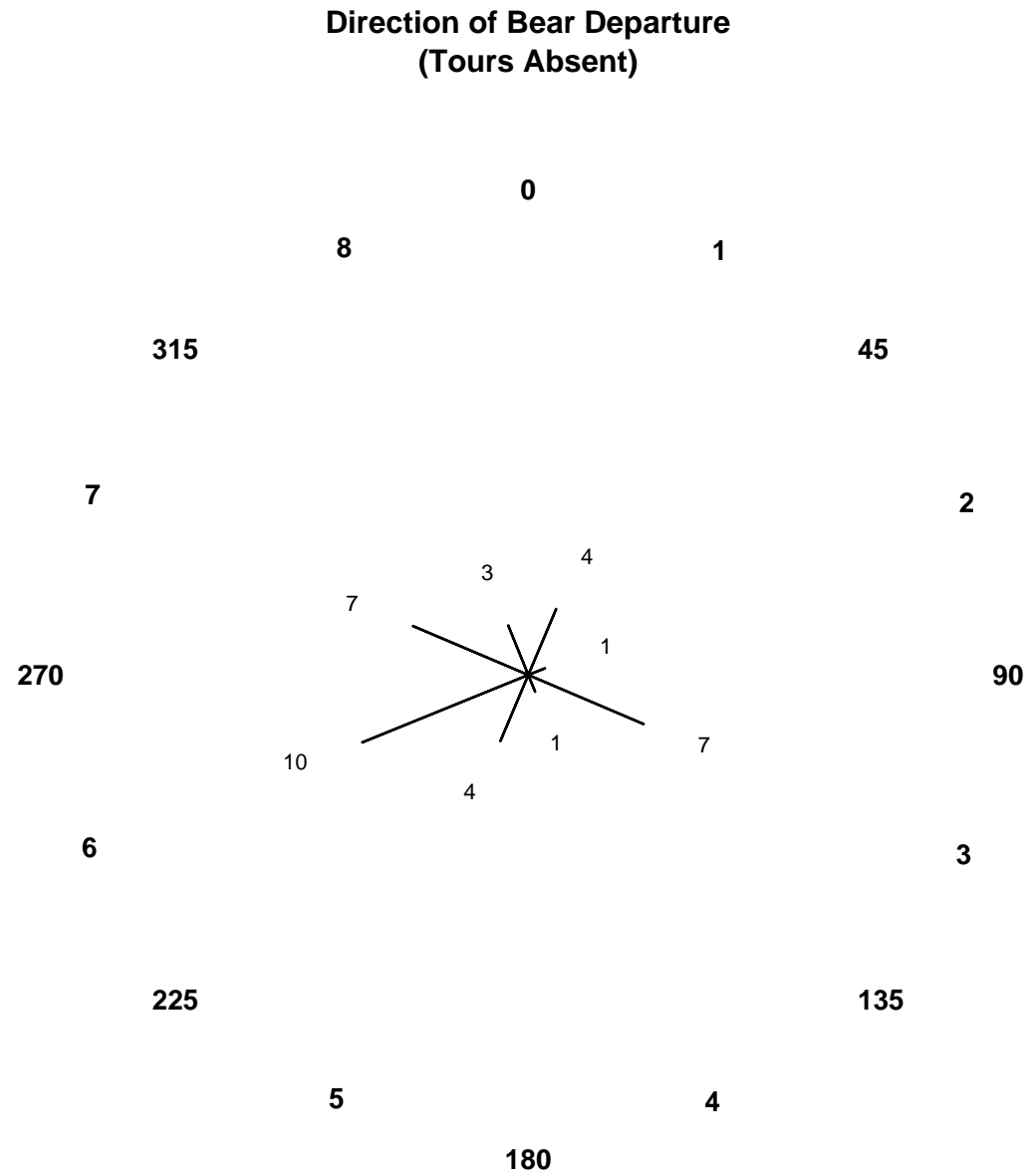


Figure 5.4.3: Arrival Distribution - Tours Present

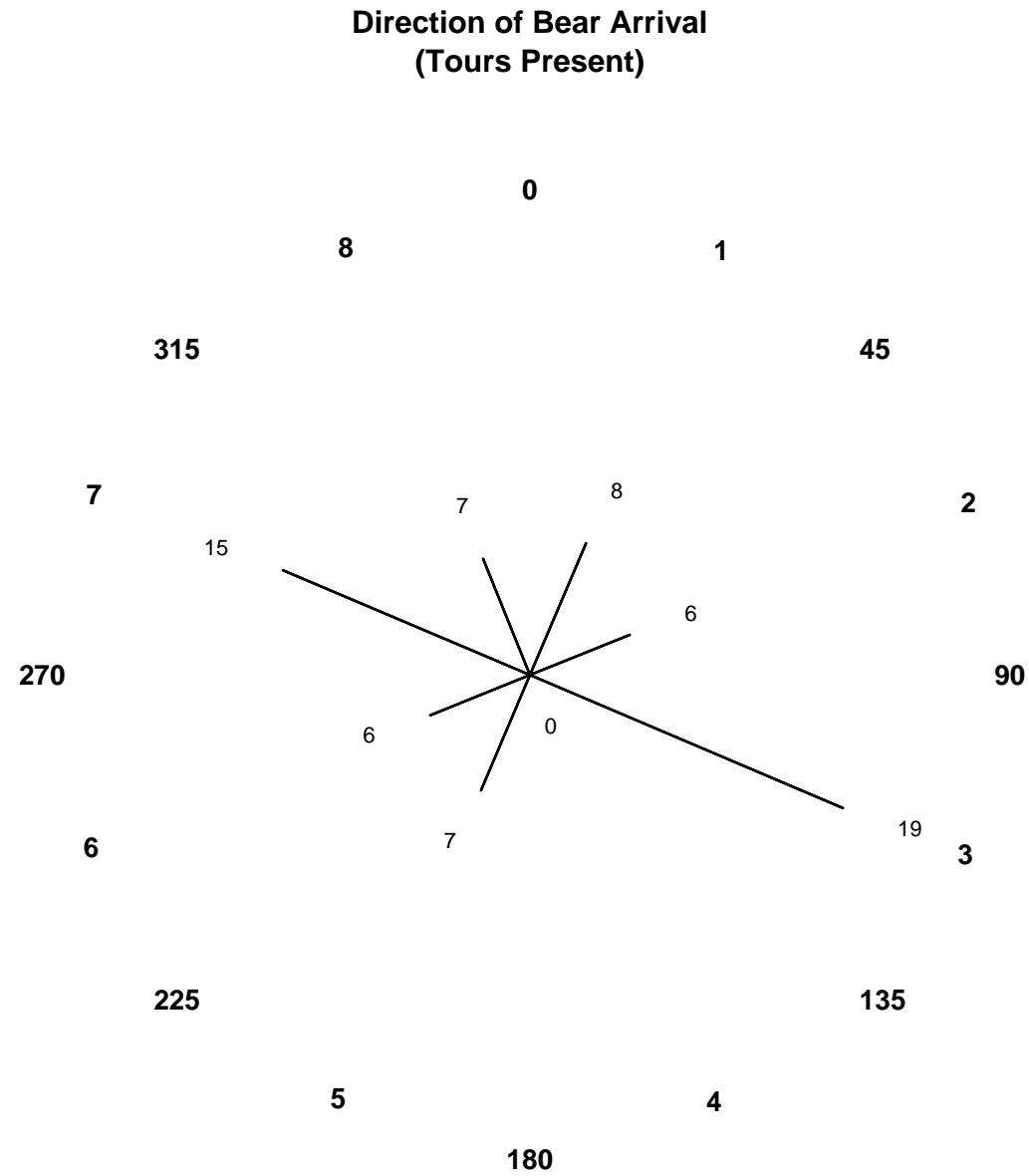


Figure 5.4.4: Departure Distribution - Tours Present

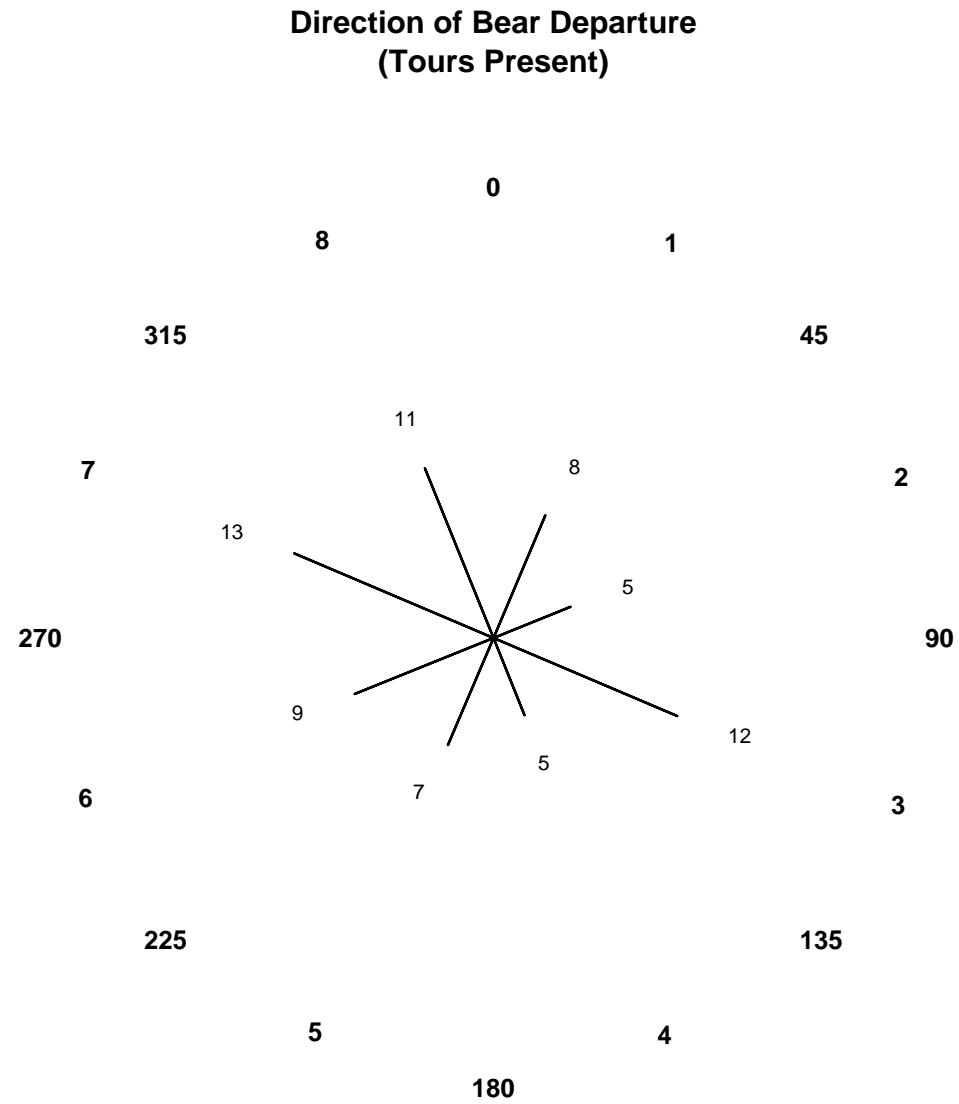


Figure 5.6.1: Bio-Energetic Effects of Disturbance

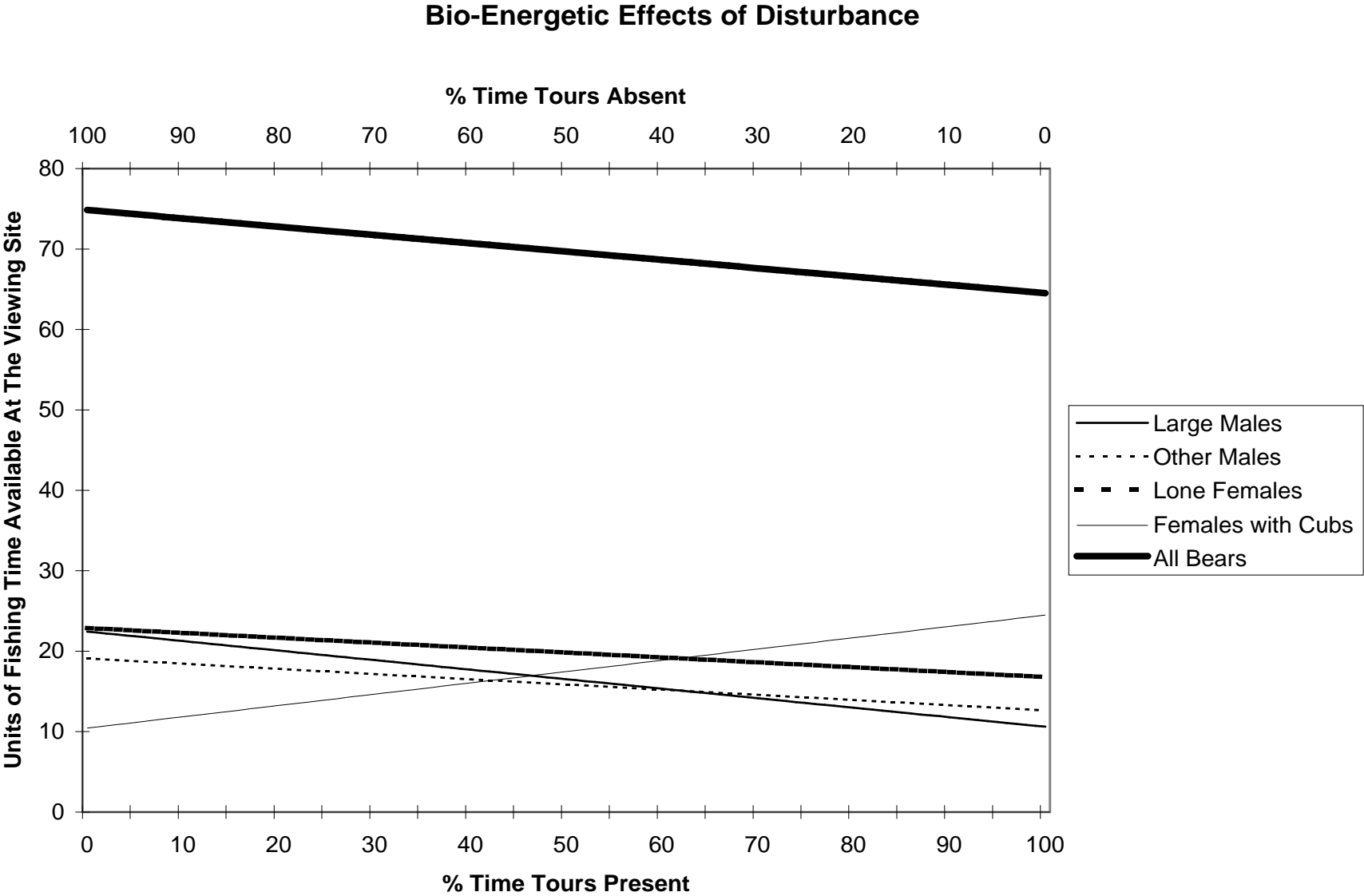


Figure 8.1.1.1: Access Ramp

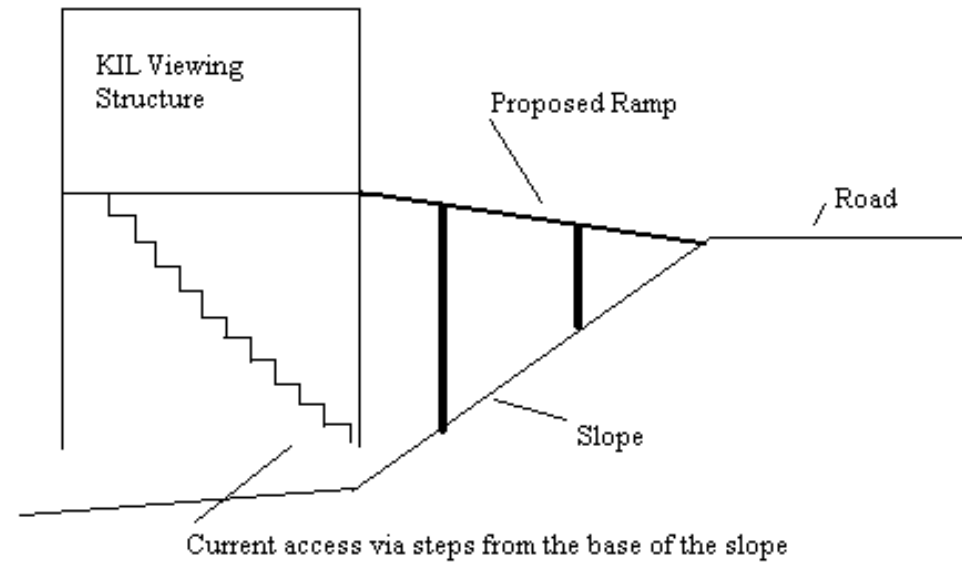


Figure 8.1.1.2: Roadway

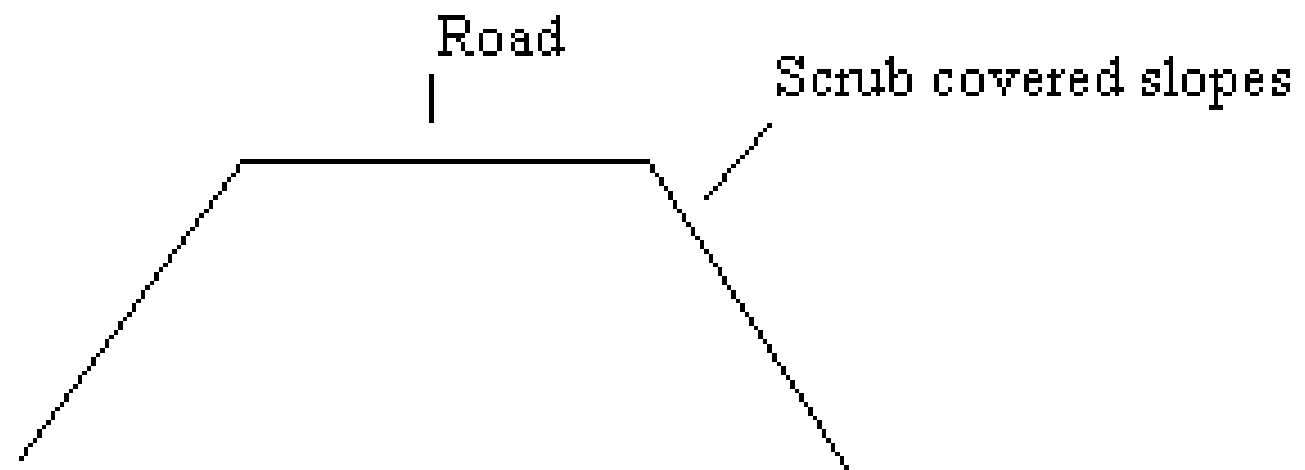


Figure 8.1.1.3: Raised Walkway

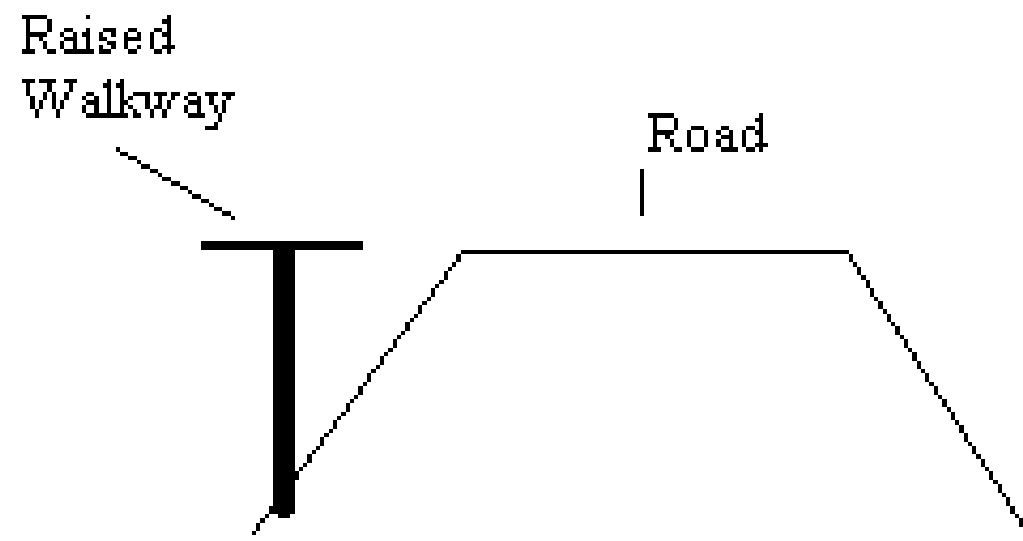


Figure 8.1.1.4: Raised Walkway (Side View)

